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# Best $L^2$-Extension of Algebraic Polynomials from the Unit Euclidean Sphere to a Concentric Sphere

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**Abstract**—We consider the problem of extending algebraic polynomials from the unit sphere of the Euclidean space of dimension $m \geq 2$ to a concentric sphere of radius $r \neq 1$ with the smallest value of the $L^2$-norm. An extension of an arbitrary polynomial is found. As a result, we obtain the best extension of a class of polynomials of given degree $n \geq 1$ whose norms in the space $L^2$ on the unit sphere do not exceed 1. We show that the best extension equals $r^n$ for $r > 1$ and $r^{n-1}$ for $0 < r < 1$. We describe the best extension method. A.V. Parfenenkov obtained in 2009 a similar result in the uniform norm on the plane ($m = 2$).

**Keywords:** polynomial, Euclidean sphere, $L^2$-norm, best extension.

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